CRITERIA FOR APL ACCEPTANCE
DETECTABLE WARNING DEVICE/TRUNCATED DOMES

A. Standards

The following are incorporated into the criteria by reference:

1. Americans with Disabilities Act (ADA) Accessibility Guidelines, Section 705—Detectable Warnings;

2. Draft Guidelines for Accessible Public Rights-of-Way;

3. American Association of State Highway and Transportation Officials (AASHTO) Standard Practice MP 12-04 for Detectable Warning Surfaces

4. Accessible Public Rights-of-Way Design Guide;

5. Detectable Warnings: Synthesis of US and International Practices; and

6. Detectable Warnings Update.

B. Definition

A "detectable warning device" is: "A standardized surface feature built to walking surfaces to warn visually-impaired people of hazards on a circulation path."

1. Size: The detectable warning device (DWD) shall extend the full width of the curb ramp (exclusive of flared sides) and shall extend 24 inches (610 mm) deep minimum measured from the back of the curb on the ramp surface.

2. Domes
   a. Alignment: Domes shall be aligned in a square grid in the predominant direction of travel.

   b. Size: Truncated domes in a detectable warning surface shall have a minimum base diameter of 0.9 inches (23 millimeters, mm) and a maximum base diameter of 1.4 inches (36 mm). The top diameter shall be a minimum of 50% and a maximum of 65% of the base diameter. The height of a truncated dome shall be 0.2 inches (5.1 mm).

   c. Spacing: Truncated domes in a detectable warning surface shall have a minimum center-to-center spacing of 1.6 inches (41 mm) and a maximum center-to-center spacing of 2.4 inches (61 mm). There shall be a minimum base-to-base spacing of 0.65 inches (17 mm), measured between adjacent domes on a square grid.

3. Visual Contrast: Detectable warning strips shall contrast visually with the adjacent walking surfaces either light-on-dark or dark-on-light.

C. Installation

Manufacturers shall provide detailed installation instructions with their product. Installation shall be in accordance with the manufacturer's instructions and current industry practices. The manufacturer's instructions shall take precedence when a conflict appears between the instructions and current industry practice.

D. Specifications

Detectable warning strip units shall conform to the following criteria, as appropriate:

1. General
   a. The truncated domes must conform to the dimensions contained in the ADA Draft Guidelines for Public Right-of-Way, and be uniform in size, shape and texture;

   b. Detectable warning strip units shall embed a minimum of three-eighths of an inch (3/8 in.), exclusive of the height of the domes, into the surface of the sidewalk ramp. This requirement can also be met with fins, anchors or similar systems.

   c. Detectable warning surfaces shall be recessed into the curb ramp so that the surface of the detectable warning strip, exclusive of the dome, is flush with the surface of the ramp to a tolerance of one-sixteenth of an inch (+/- 1/16 in.);

   d. Detectable warning strip components shall be pre-fabricated. There shall be no on-site fabrication of truncated domes;

   e. Wet or dry installations of the DWD are acceptable;

   f. Detectable warning strips shall be skid resistant;

   g. Detectable warning strips shall be rigid, inflexible and non-yielding. No soft or pliable materials are allowed; and

   h. Detectable warning strips shall be non-flammable.

   i. Long term Performance; Products used on Arizona's detectable warnings must provide a service life that will not create maintenance problems and that is synchronized with our normal road maintenance schedules. While a minimum of twenty years would be costly in terms of continued maintenance, such a life cycle maybe acceptable. A service life of forty years or more seems to be reasonable for this type of product and should be considered the desired minimum service life for detectable warning materials.

   j. Wet resistance and dry resistance should conform to different criteria. An average wet/dry slip resistance not less than (Dry= 0.8, and Wet= 0.60) per American Society for Testing and Materials (ASTM) C 1028;

2. Categories
   a. Paver Blocks: Concrete pavers should meet or exceed the requirements established in ASTM C 936, Standard Specifications for Solid Interlocking Concrete Paving Units. These requirements are as follows:

Paver Blocks			
Tests	**Test Method**	**Requirement**	**Test Results**
Average Compressive Strength, minimum	ASTM C936	8,000 psi	
Average flexural strength, minimum	ASTM C293	1,000 psi	
Water Absorption, maximum	ASTM C936	average 5% individual 7%	
Resistance to a minimum of 50 freeze-thaw cycles, maximum	ASTM C666	0% material loss, 20% relative dynamic modulus elasticity loss	
Abrasion resistance tests Average thickness loss	ASTM C418	0.118 inch (3 mm)	
Average Volume loss on the DWD domes tested, maximum	Florida Test Method FM 5-594 and Florida Standard Spec 527	0.06 cm^3	
Average Slip Resistance, minimum	ASTM C1028	Wet/dry 0.6/0.8	
Adhesion/Bond strength	ASTM C482	no adhesion failure	
Impact Strength of domes	ASTM D5420	550 inch-lbs.*	

* Report results.

b. Concrete Tiles and Panels: Concrete tiles and panels (defined by products that use a modified Portland cement based binder and fine aggregates in addition to other additives such as polymers and fibers) should meet or exceed the following property requirements as measured by the cited ASTM tests:

Concrete Tiles and Panels			
Tests	**Test Method**	**Requirement**	**Test Results**
Average Compressive Strength, minimum	ASTM C39	8,000 psi	
Average flexural strength, minimum	ASTM C947	1,000 psi	
Water Absorption, maximum	ASTM C936	average 5% individual 7%	
Resistance to a minimum of 50 freeze-thaw cycles, maximum	ASTM C666	0% material loss, 20% relative dynamic modulus elasticity loss	
Abrasion resistance tests Average thickness loss Average Volume loss, on the DWD domes tested, maximum	ASTM C418	0.118 inch (3 mm)	
	FM 5-594	0.06 cm^3	
Average Slip Resistance, minimum	ASTM C1028	Wet/dry 0.6/0.8	
Adhesion/Bond strength	ASTM C482	no adhesion failure	
Impact Strength	ASTM D5420	550 inch-lbs.*	

* Report results.

c. Polymer Concrete Tiles and Panels: Polymer Concrete Tiles and Panels (defined by using a polymeric based binder and fine aggregates), should meet or exceed the following property requirements as measured by the cited ASTM tests:

Polymer Concrete Tiles and Panels			
Tests	**Test Method**	**Requirement**	**Test Results**
Average Compressive Strength, minimum	ASTM C109	8,000 psi	
Average Flexural Strength, minimum	ASTM C293	3,000 psi	
Average Splitting Tensile Strength, minimum	ASTM C496 or C1006	1,500 psi	
Impact Strength, minimum	ASTM D5420	550 inch-lbs.	
Average Water Absorption, maximum	ASTM D570	1%	
Resistance to a minimum of 50 freeze-thaw cycles, maximum	ASTM C666	0% material loss, 20% relative dynamic modulus elasticity loss	
Color Change ΔE on the panel when weathered for 2000 hours with UV light, with spray and condensation in the cycles, maximum	ASTM G155	5.0	
Abrasion resistance tests Average thickness loss	ASTM C418	0.118 inch (3 mm)	
Average Volume loss, on the DWD domes tested, maximum	Florida Test Method FM 5-594 and Florida Standard Spec 527	0.06 cm^3	
Average Slip Resistance, minimum	ASTM C1028	Wet/dry 0.6/0.8	
Impact Strength, minimum	ASTM D5420	555 inch-lbs.*	

* Report results.

d. Composite Tiles, Vitrified Polymer Panels: Composite Tiles, Vitrified Polymer Panels should meet or exceed the following property requirements as measured by the cited ASTM tests:

Composite Tiles and Panels			
Tests	**Test Method**	**Requirement**	**Test Results**
Average Compressive Strength, minimum	ASTM D695	18,000 psi	
Average Flexural Strength, minimum	ASTM D790	24,000 psi	
Average Tensile Strength, minimum	ASTM D638	10,000 psi	
Color Change ΔE on the panel when weathered for 2000 hours with UV light, with spray and condensation in the cycles, maximum	ASTM G155	5.0	
Flame Spread Index, maximum	ASTM E84	25	
Exposure to Chemicals	ASTM D543	No change on the panel	
Impact Strength, minimum	ASTM D5420	550 inch-lbs.	
Average Water Absorption, maximum	ASTM D570	0.5%	
Average Slip Resistance, minimum	ASTM C1028	Wet/dry 0.6/0.8	
Impact Strength, minimum	ASTM D5420	550 inch-lbs.*	

* Report results.

e. Metal: Metallic products made of cast iron and stainless steel should meet or exceed the following property requirements as measured by the cited ASTM tests:

Metallic Plates			
Tests	**Test Method**	**Requirement**	**Test Results**
Color Change ΔE on the panel when weathered for 2000 hours, maximum	ASTM G155	5.0	
Exposure to Chemicals	ASTM D543	No discoloration or staining	
Average Slip Resistance, minimum	ASTM C1028	Wet/dry 0.6/0.8	
Exposure to Salt Spray for 200 hours	ASTM B117	No change on the panel	
Abrasion resistance tests, average Volume loss on the DWD domes tested, maximum	FM 5-594	0.06 cm^3	
Impact Strength, minimum	ASTM D5420	550 inch-lbs.*	

* Report results.

f. Surface mount products: Surface mount products should meet all criteria for the specific category of the product type listed above. In addition, the applicant should address and validate the methods to verify the mechanism of attachment either by bonding agents, or mechanical fasteners. The bonding agents or mechanical fasteners must be tested to ensure that the chances for delamination or failure during the service life and loading conditions are minimized. Anchor pull out strength must be reported as measured by one or more ASTM tests:

Recommended anchor pullout test methods:

1) ASTM E754 “Standard Test Method for Pullout Resistance of Ties and Anchors Embedded in Masonry Mortar Joints”;
2) ASTM E488/E488M “Standard Test Methods for Strength of Anchors in Concrete Elements”;
3) ASTM E1512 “Standard Test Methods for Testing Bond Performance of Bonded Anchors (Adhesive bonded anchors, dry set)”.

Recommended adhesion bond strength test methods:

1) ASTM C1583/C1583M “Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)”.

g. Alternative Materials: Alternative materials not specifically covered by these guidelines will be evaluated by ADOT on a case by case basis.